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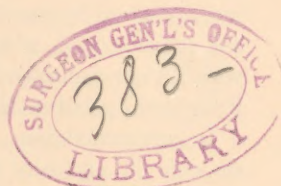


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A CONTRIBUTION TO THE MANAGEMENT OF INITIAL
MYOPIA ACQUISITA.¹

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THE emmetropic, or the non-progressive slightly myopic, eye is best suited to the occupations of civilized life, because it has most endurance when taxed by objects within the limit of distance at which rays of light sensibly diverge. Hyperopia is the typical refraction; "the refraction of neonati is exclusively hyperopic."² That this condition persists, or changes but slightly, in the lower animals and in human beings who lead an out-door life, away from occupations requiring precise ocular attention to objects within the length of the arm; that the refraction increases with the years of an individual up to twenty-five, and beyond, if he be engaged continuously with small objects near him, are points established by statistics.

The hyperopic eye, unlike the emmetropic or myopic eye, is to a greater degree a vital organ, rather than an optical machine arranged for a given class of work. It has more life and adaptability, adjusting itself for the *best* definition of images at different distances and of varying sizes. Objects appear more brilliant to it—because, it accommodates for *every* object at whatever distance, and the ciliary muscle is better developed by this constant exercise; and because, with this constant effort at accommodation are associated movements of the choroid and retina, the perceptive elements being thus kept in a constant state of healthful tension. Objects are smaller and brighter, and more clearly defined.

A hyperope can see farther and more accurately when the atmosphere contains more than the usual amount of moisture, or in a fog; myopic vision is increased by such conditions.

Nature did not build eyes for vision limited to twenty feet, though she adapts, or endeavors to adapt, them to the uses to which they are subjected. Hence, the increasing tendency to myopia in civilization,

¹ Read at the meeting of the American Ophthalmological Society, July 18, 1889.

² Koenigstein, *Wien. med. Journ.*, p. 47, 1881.

for the percentage of myopia in a given race is an approximate measure of its civilization. The myopic eye can work in a *lower* illumination on account of the apparent size of the objects, which it magnifies.

Myopia and chronic nasal catarrh are *vestigia* of luxury. Houses exclude light, distance, and cold air; the handkerchief is limited to the civilized human being.

How does nature, in her effort to adapt the human eye to its environment, change hyperopia into myopia, or myopic astigmatism? This is the question with which this paper will attempt briefly to deal; for, with a clear conception of the *modus operandi* of structural changes, we have positive indications for the prevention of such processes.

In accommodation, the ciliary muscle, by its contraction, advances the choroid, and with it the retina. This action of the muscle has been observed through a sclero-corneal incision opposite the muscle, and also by the swaying of the heads of pins stuck perpendicularly into different parts of the choroid (Hensen and Voelckers). This movement of the choroid increases the pressure of the corpus vitreum on the lens: the lens is carried against the iris, which being contracted offers resistance to the lens, except in the pupillary space where the lens becomes most convex. Whether the lens becomes more convex by its own elasticity during relaxation of the zonule, or, whether the circular fibres *press* by their ciliary processes on the equator of the lens (Müller), it is unnecessary to the purpose of this discussion to decide. We are also to exclude that class of myopia into which inherited tendency enters as a factor, so far as this is indicated by its existence in some progenitor, and limit our consideration to the action of the most potent cause of myopia, *ab initio*.

Among civilized people the objects which engage their attention from earliest childhood are, for the most part, included within the four walls of a room; generally within reach of their hands. After having fixed the mode of production of myopia, it will be proper to decide if it be best to *prevent* it, that being possible; if it be best to prevent entirely our adaptation by nature to our changed environment, or to limit only this process of adaptation. This is a question to be studied and discussed in the interest of coming generations, with a view to its settlement by ourselves, or others.

A slightly myopic eye seems best suited to the needs of present training, and trained occupations, though it would not have been so effective in the pastoral and nomadic modes of life of the past. It is better suited to a race of students and to kindred employments. The danger lies in the too rapid enforcement of the structural changes necessary. If these could be limited in the individual, and reach proper development slowly through several generations, each one bearing its own share of the adaptation, disease processes might be avoided, and, with this, the inherited tendency to certain affections of the eye. No one

organ can be good for everything. The hyperopic eye was perfect for its uses in the past, but it has, in a measure, given way to the so-called emmetropic eye, which must in turn be superseded by the eye of still higher refraction, with the least damage from the process.

The hyperopic eye always exercises some accommodation to secure definition of image, even at infinite distance, and the demand upon accommodation increases in inverse ratio to the size and distance of the object. Such eyes are rarely at rest. The anatomical peculiarities of the region supplied by the trigeminus are not fixed until after the period of second dentition, during which the greatest exactions are made upon it by our methods of education and preparation for the future duties of life. Tonic ciliary spasm simulating myopia, or myopic astigmatism, is not infrequent. Schweigger says myopia is often developed in children after measles, or scarlet fever; diseases which offer a legacy of muscular asthenia predisposing to muscular spasm of taxed muscles, of which the ciliary muscles are most prominent, as during convalescence they are most relied upon for amusement.

Constant and excessive action of the ciliary muscle causes disturbance in the uveal tract by the continuous motion of the choroid, with the alternate compression and relaxation of the bloodvessels resulting from it. The advancement of the choroid and corpus vitreum means an increase in the antero-posterior diameter of the bulb. With this state of things persisting while this whole region is adapting itself during the period of second dentition and diminished general vigor, especially after the exanthemata, is it surprising that the eye should become fixed with an abnormally long antero-posterior diameter? This shape and position having been maintained for some months the tissues lose their resiliency, and when the spasm is relaxed, the eye does not promptly, if ever, recur to its former condition. This mishap occurs too upon the threshold of the sexual life, when the slightest influences have an exaggerated and permanent effect. The myopic process begun at this time is with difficulty interrupted, though it may sometimes be limited by prompt and decided measures, unless in case of inherited tendency.

Irritation of *one* ciliary nerve may cause contraction of the ciliary muscle and the iris, and the advancement of the choroid and vitreous body in the *one* section to which it is distributed. Thus, astigmatism may be inaugurated. To object that astigmatism depends upon asymmetrical curvature of the cornea, is to lose sight of the fact that when the vitreous is advanced it is probably narrowed, that the shape of all the tissues is modified, the cornea as well as the rest.

If the, at this time, temporary malformation of the bulb, and the associated uveal excitement, are not restored to the previous conditions, the prospect of recovery grows less, and inflammatory disturbances of the fundus may supervene.

The means at our command for the accomplishment of this purpose are simple, based upon the rational indications, and have been found effective. If not all elasticity of the tissues is lost by delay, the persistent use of atropia in suspending accommodation will permit a recurrence to the earlier refractive power; and, by the rest it affords, relieve the choroido-retinal perturbation. A solution of atropia, 1 : 120 parts, should be used, one drop in each eye, every second, third, or fourth day, *pro re nata*; combine with this a London-smoke + lens, as strong as is tolerated, to be worn, and for a necessary time all near-work must be suspended. Some months are required to gain the best effect, which is the chief impediment to success. The true American, the child as well as the adult, living in the same atmosphere of nervous excitement, and impressed with an exalted idea of the importance of what he is endeavoring to do and the short space of time in which it must be done, has no appreciation of the conservation of energy. He has a life to live, and wants to get through with the *business*. He looks upon physical integrity as an accomplishment, rather than important to the real purpose of life. He is very impatient of time *lost* in securing to himself the physical advantages already possessed, and will probably more than once infringe the rules given for his guidance and risk the success of the effort made in his behalf. After the *best* effect of the mydriatic has been secured it may be suspended, the length of time the eyes may be used is arranged, the strongest + lens through which the individual can read at 36 cm. distance is prescribed, and he is to be forbidden to approach the object more nearly. He is to read nothing that cannot be easily seen at the given distance with the lens. This plan, repeated as necessary, will establish the improved condition, in a length of time varying with different individuals.

I hereto append a few cases in point:

CASE I.—*June 19, 1882.* Miss M., aged thirty-two. Since 1876 has noticed that she could not recognize acquaintances across the street. Has had pain in her eyes for four months. Her vision is worse after concentration for a time upon some near object; has decided photophobia and often congestion of the bulbar conjunctiva. V., each = $\frac{20}{CC}$. Reads Jaeger's No. 1, easily with either eye, at 12 in. With — 3 Ds., V., each = $\frac{20}{xx}$. A solution of atropia, 1 : 240, and a + .5 Ds. lens for reading were prescribed to relax A. (as has since been suggested by Landolt in his work on *Accommodation and Refraction of the Eye*).

August 1. + 1. Ds. each was prescribed, and the atropia was continued.

August 10. V. each = $\frac{12}{C}$.

January 11, 1883. Under this treatment continued V., each = $\frac{20}{C-}$.

November 12. No farther improvement, and — 1.75 Ds. were prescribed for distance, giving V., each $= \frac{20}{xx}$.

July 16, 1884. I examined the eyes again with the same result.

Six years is a long time for tonic spasm of the ciliary muscle to exist without some structural change, which had taken place in this case, probably. After thirty, the tissues naturally have less elasticity than earlier in life. The patient was a government employé and was compelled to continue desk-work during the treatment. These three facts may explain why success in this case was not better even than it was.

CASE II.—July 29, 1882. F. C. H., aged twenty, a student of civil engineering, complains of nothing except indistinct vision for distant objects. V., each $= \frac{20}{Lxx}$; with — 2 Ds., each $= \frac{20}{xx}$. Reads Jaeger's No. 1 at 21 in., and at 5 in.

He was seen at intervals until February 4, 1884, and under the treatment carried out as well as possible while the young man was attempting to keep up with his class, with — 1.25 Ds., V., each $= \frac{20}{xx}$.

July 22, 1884. The same condition existed. His mother is a myope.

CASE III.—February 3, 1886. F. L. H., a schoolboy of twelve years. He is small, and does not look strong, though ordinarily vigorous by report. He is very fond of books, and reads nearly all the time in bad light and in awkward positions. Distant objects "are blurred; not clear as they used to be." V., each $= \frac{20}{xx-}$. Prescribed — .75 Ds., for distance only, with instructions to maintain *always* a distance of fifteen inches from his book, to read in a good light, not lying down.

October, 1888. He returned with V. R. $= \frac{20}{Lxx-}$; V. L. $= \frac{20}{Lxx-}$.

V. R. =, with — 1.25 Ds., $\frac{20}{xx}$.

V. L. =, with — 1. Ds., $\frac{20}{xx}$.

Subjected to the course of treatment indicated, with cold-water douche to the eyes, he has gradually improved as the following tests declare:

Nov. 10. V. R. $= \frac{20}{L}$; 20th, $= \frac{20}{XL}$; Dec. 22, $= \frac{20}{xxx}$; Jan. 19, $= \frac{20}{xx}$

" V. L. $= \frac{20}{L}$; " $= \frac{20}{XL-}$; " $= \frac{20}{xxx}$; " $= \frac{20}{xx}$

February 1. The atropia was suspended, while the + .5 Ds. lenses were continued, but February 9th, having recovered from the influence of the mydriatic, V. was slightly blurred.

July 1, 1889. The result of the test, V., each, $\frac{20}{xx}$.

CASE IV.—June 16, 1888. W. W., aged seventeen years, consulted me in great distress. He had been rejected, upon a physical examination for West Point, the Examining Board having reached the conclusion

that there was myopic astigmatism of the right eye, and myopia of the left eye. Upon examination, $V. R. = \frac{20}{LXX}$; $V. L. = \frac{20}{XX-}$. Jaeger's No. 1 could be read easily at 12 inches. After the instillation of atropia he was again examined.

18th. $V. R. = \frac{20}{LXX}$; 19th, $\frac{20}{LXX}$; with — 1. Ds. $= \frac{20}{XX}$; 26th, $= \frac{20}{XXX}$
 “ $V. L. = \frac{20}{XXX}$; “ $\frac{20}{20}$

The last part of July, $V. R. = \frac{20}{XX}$, under the continued treatment.

He was advised to abandon his intended plan of going to West Point, because the integrity of his eyes could not be preserved under the exactions to which they would be subjected there, and he would be rejected at the close of his term. This course was followed, and he has since been studying at home.

September. $V.$, each $= \frac{20}{XX}$. He used his eyes in a bad light, and in

December, $V.$, each $= \frac{20}{XX-}$.

February 19, 1889. He has been using his eyes six or eight hours daily since early in December, in reading, maintaining a proper position and with a good light, without manifest disadvantage. $V. = \frac{20}{XX-}$, each.

The father had hyperopic astigmatism of both eyes. An elder brother, whom I examined in June, 1883, when near the end of his course at the Naval Academy, at Annapolis, had a compound myopic astigmatism of about 5 D., which I suspect has increased. Of two sisters, the elder at eighteen years was myopic: $R. E. = 2. D.$; $L. E. = 1.25 D.$ The younger, October, 1882, eight years old, was hyperopic, 1.25 D., and during the more than six years that have elapsed, the refraction has not varied. She has been going to school during this time, and has been under my observation. She has worn a correcting glass, read in proper position, and maintained the proper distance between her eyes and her books. She has developed well, though she had grown so slowly until she put on lenses that her parents feared she would be dwarfed. The influence of the glasses was proven by the prompt growth of the child immediately upon their adaptation.

The relief, and the gain in general nutrition and strength, afforded by the timely use of proper convex lenses in hyperopia show the exhaustive effort required of the ciliary muscle by our civilized surroundings. Unless some rational and systematic mechanical method is adopted in anticipating and avoiding the evils which result, nature will compensate for the continual demand upon the ciliary muscle, by modifying the eye to suit the altered conditions, in order to save the rest of the body from exhaustion, and from the arrest of development arising from overtaxing one set of muscles at the early age at which our children are subjected to our forcing educational methods.

Shall we interfere by artifice with nature's process in adapting the eye of the Past to the needs of the Present, until what is best can be settled? Or, shall we permit the young to drift into danger from progressive myopia, and the evils it entails upon themselves and their posterity by inheritance?

A concave glass is only an attempted compensation for mischief accomplished in part, or in whole.

